

We claim:

1. A channel estimator for a packet data communications receiver, the channel estimator comprising:
 - an input to receive data for symbols of a data packet transmitted over a channel to said receiver;
 - a memory to store said received symbol data;
 - a training sequence determiner to determine a training sequence using one or more variable data portions or fields of said data packet; and
 - an adaptive filter coupled to said memory and to said training sequence determiner and configured to use said received symbol data and said training sequence to determine an estimate of a response of said channel.
2. A channel estimator as claimed in claim 1 wherein said training sequence determiner is configured to determine said training sequence by determining one or more substantially constant elements of said one or more variable data portions or fields of said data packet.
3. A channel estimator as claimed in claim 1 wherein said training sequence determiner is configured to determine said training sequence by determining probabilities for values of bits or symbols of said one or more variable data portions or fields of said data packet.
4. A channel estimator as claimed in claim 3 wherein said training sequence is determined by determining random values for said bits or symbols weighted by said probabilities.
5. A channel estimator as claimed in claim 3 wherein said training sequence is determined by selecting values for said bits or symbols dependent upon the probabilities of the selected values in comparison to a threshold.

6. A channel estimator as claimed in claim 1 wherein said training sequence determiner is configured to determine said training sequence by decoding data for at least a portion of a header of a said packet.
7. A channel estimator as claimed in claim 1 wherein said training sequence determiner is configured to determine said training sequence by decoding data for at least a portion of a user data payload of a said packet.
8. A channel estimator as claimed in claim 6 wherein said training sequence determiner is further configured to check said decoded data for errors, and wherein said channel response estimate is determined conditionally upon no errors being detected in said decoded data.
9. A channel estimator as claimed in claim 1 wherein said adaptive filter is configured to use said training sequence more than once to determine said estimated channel response.
10. A channel estimator as claimed in claim 9 wherein said adaptive filter is configured to employ an algorithm having a stepwise convergence to a solution and wherein a step size of said algorithm is reduced after said training sequence has been used once.
11. A channel estimator as claimed in claim 1 wherein said training sequence determiner is configured to determine more than one training sequence for a received data packet; and wherein said adaptive filter is configured to determine a first estimated channel response using a first said training sequence and a second estimated channel response using a later said training sequence.
12. A channel estimator as claimed in claim 11 wherein said first training sequence is derived from a packet header and said later training sequence is derived from payload data of said packet.

13. A channel estimator as claimed in claim 12 wherein said adaptive filter is configured to determine a plurality of said later training sequences for updating said second estimated channel response.
14. A channel estimator as claimed in claim 11, further comprising a payload data memory to store erroneously received payload data and an equaliser to equalise payload data in said payload data memory using said second estimated channel response to attempt to correct said erroneous data.
15. A channel estimator as claimed in claim 11 further comprising an initialiser to initialise said adaptive filter using said first estimated channel response for determining said second estimated channel response.
16. A channel estimator as claimed in claim 1 further comprising a channel estimate store and an initialiser to initialise said adaptive filter with data from said channel estimate store.
17. A channel estimator as claimed in claim 16 wherein said channel estimate store is configured to store a channel estimate for a data packet immediately preceding said data packet for which said adaptive filter is configured to determine an estimated channel response.
18. A channel estimator as claimed in claim 16 comprising a plurality of said channel estimate stores each corresponding to a data link, to store a plurality of channel estimates and a plurality of associated link identifiers, and wherein said filter initialiser is configured to initialise said adaptive filter with a channel estimate associated with a data link over which said symbols are received.
19. A channel estimator as claimed in claim 1 further comprising a power controller responsive to a power control signal to control said determination of said estimated channel response.

20. A Bluetooth data receiver including a channel estimator for a packet data communications receiver, the channel estimator comprising:
- an input to receive data for symbols of a data packet transmitted over a channel to said receiver;
 - a memory to store said received symbol data;
 - a training sequence determiner to determine a training sequence using one or more variable data portions or fields of said data packet; and
 - an adaptive filter coupled to said memory and to said training sequence determiner and configured to use said received symbol data and said training sequence to determine an estimate of a response of said channel.
21. A High Rate Bluetooth data receiver for receiving High Rate Bluetooth data packets, the receiver including a channel estimator, the channel estimator comprising:
- an input to receive data for symbols of a data packet transmitted over a channel to said receiver;
 - a memory to store said received symbol data;
 - a training sequence module configured to provide a training sequence comprising at least a synchronisation word of a said High Rate Bluetooth data packet; and
 - an adaptive filter coupled to said memory and to said training sequence module and configured to use said training sequence and said received symbol data to determine an estimate of a response of said channel.
22. A Bluetooth data receiver as claimed in claim 21 wherein said training sequence further comprises at least half the preamble sequence of a said High Rate Bluetooth data packet.
23. A method of determining an estimated response of a channel of a packet data communications system, the method comprising:
- receiving data for symbols of a data packet transmitted over the channel;
 - determining a training sequence using one or more variable data portions or fields of said data packet; and

training an adaptive filter using said training sequence and said received symbols to determine said estimated channel response.

24. A method as claimed in claim 23 wherein said determining comprises determining one or more substantially constant elements of said one or more variable data portions or fields of said data packet.
25. A method as claimed in claim 23 decoding data for at least a portion of a header of a said packet determining probabilities for values of bits or symbols of said one or more variable data portions or fields of said data packet.
26. A method as claimed in claim 25 wherein said determining further comprises determining random values for said bits or symbols weighted by said probabilities.
27. A method as claimed in claim 25 wherein said determining further comprises selecting values for said bits or symbols dependent upon the probabilities of the selected values in comparison to a threshold.
28. A method as claimed in claim 23 wherein said determining comprises decoding data for at least a portion of a header of a said packet.
29. A method as claimed in claim 23 wherein said determining comprises decoding data for at least a portion of a user data payload of a said packet.
30. A method as claimed in claim 28 wherein said determining further comprises checking said decoded data for errors, and wherein said training is conditional upon said checking finding no errors.
31. A method as claimed in claim 23 further comprising repeating said training using said training sequence.

32. A method as claimed in claim 31 wherein said adaptive filter is configured to employ an algorithm having a stepwise convergence to a solution, the method further comprising reducing a step size of said algorithm when repeating said training.
33. A method as claimed in claim 23 wherein said determining comprises determining a plurality of said training sequences for said data packet, said training determining a first estimated channel response using a first said training sequence and a second estimated channel response using a later said training sequence.
34. A method as claimed in claim 33 wherein said first training sequence is derived from a packet header and said later training sequence is derived from payload data of said packet.
35. A method as claimed in claim 34 wherein said determining further comprises determining a plurality of said later training sequences for updating said second estimated channel response.
36. A method as claimed in claim 33 wherein said determining of said second estimated channel response uses said first estimated channel response for initialising said training.
37. A method as claimed in claim 33 further comprising storing erroneous payload data and processing said erroneous data using said second estimated channel response to attempt to correct said erroneous data.
38. A method as claimed in claim 23 further comprising initialising said adaptive filter using previously stored estimated channel response data.
39. A method as claimed in claim 38 wherein said previously stored estimated channel response data comprises estimate data derived from a data packet immediately preceding said data packet.

40. A method as claimed in claim 38 further comprising storing estimate data for a plurality of channels; determining a current channel; and initialising said adaptive filter with estimate data for said current channel.
41. A method as claimed in claim 23 further comprising adjusting said training responsive to a desired power consumption signal.
42. A method as claimed in claim 23 wherein said packet data communications system is a High Rate Bluetooth data communications system.
43. A method of estimating a response of a High Rate Bluetooth data channel, the method comprising:
- receiving data for symbols of a data packet transmitted over the channel;
 - providing a training sequence comprising at least a synchronisation word of a High Rate Bluetooth data packet for reception by said receiver; and
 - training an adaptive filter using said training sequence and said received symbols to determine said estimated channel response.
44. A method of determining or providing a training sequence comprising determining an estimated response of a channel of a packet data communications system, the method comprising:
- receiving data for symbols of a data packet transmitted over the channel;
 - determining a training sequence using one or more variable data portions or fields of said data packet; and
 - training an adaptive filter using said training sequence and said received symbols to determine said estimated channel response.
45. A method of determining or providing a training sequence comprising estimating a response of a High Rate Bluetooth data channel, the method comprising:
- receiving data for symbols of a data packet transmitted over the channel;
 - providing a training sequence comprising at least a synchronisation word of a High Rate Bluetooth data packet for reception by said receiver; and

training an adaptive filter using said training sequence and said received symbols to determine said estimated channel response.

46. A method of determining an estimated response of a data channel of a current data link of a data communications system having a plurality of data links each with a corresponding channel, the method comprising:

storing in a data store data for a plurality of previously determined estimates for the channels of said plurality of data links in association with data for identifying each link;

determining data for identifying said current data link;

retrieving from said data store previously determined channel estimate data for said current data link using said data for identifying said current data link;

initialising an adaptive channel estimator using said retrieved channel estimate data; and

determining said estimated response using said adaptive estimator and data received on said current data link.

47. A method of determining an estimated channel response of a data link of a packet data communications system, the method comprising:

determining an initial estimate of said channel response;

receiving and decoding at least a portion of payload data of a data packet of the system;

applying an error check to said portion of payload data to determine whether said portion of payload data has been received correctly; and

determining an updated channel estimate using said portion of payload data when said error check determines that said portion of payload data has been correctly received.

48. A method as claimed in claim 47 comprising determining a plurality of successive updated channel estimates for a single said packet using successive portions of said payload data.

49. A method as claimed in claim 47 wherein said determination of an updated channel estimate is conditional upon a previously received portion of payload data of said data packet having been erroneously received.
50. A method as claimed in claim 47 further comprising storing a previously received erroneous portion of payload data; and processing said erroneous portion of payload data using said updated channel estimate to attempt recovery of said erroneous portion of data.
51. A channel estimator configured to operate in accordance with the method of claim 23.
52. A channel estimator configured to operate in accordance with the method of claim 43.
53. A channel estimator configured to operate in accordance with the method of claim 46.
54. A channel estimator configured to operate in accordance with the method of claim 47.
55. Processor control code to, when running implement the channel estimator of claim 1.
56. A carrier carrying processor control code to, when running implement the channel estimator of claim 1.
57. Processor control code to, when running implement the Bluetooth data receiver of claim 20.
58. A carrier carrying processor control code to, when running implement the Bluetooth data receiver of claim 20.

59. Processor control code to, when running implement the method of claim 23.
60. A carrier carrying processor control code to, when running implement the method of claim 23.
61. Processor control code to, when running implement the method of claim 43.
62. A carrier carrying processor control code to, when running implement the method of claim 43.
63. Processor control code to, when running implement the method of claim 46.
64. A carrier carrying processor control code to, when running implement the method of claim 46.
65. Processor control code to, when running implement the method of claim 47.
66. A carrier carrying processor control code to, when running implement the method of claim 47.